

INTERCEPTION LOSS IN A TRIBUTARY OF MILKHOUSE CREEK

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A tributary of Milkhouse Creek has its headwaters south of Providence Hospital and flows south towards Grelot Road. This creek is lined with old growth timber stands of pine and hardwoods. Alabama Power Company wants to build 100-foot transmission line towers in the middle of this tributary. This is in order to gain access to Grelot Road and eventually link up with a substation located just east of the intersection of Grelot Road and Leroy Stevens Road. In order to accomplish this, they would have to clear-cut a 100-foot right-of-way in the middle of this old growth forest. The purpose of this research is to see the influence this right-of-way would have on the creek. To achieve this, interception measurements were taken in the area of the creek and in an existing 100-foot right-of-way. Through the interception measurements, I am able to show that there will be an increase in the amount of rainfall the creek will see if the timber is cut down. The resulting data shows that the trees capture a significant portion of rainfall and that an increase in the amount of rainfall in the creek will increase erosion, discharge, and the potential for flooding of Grelot Road.

Keywords: Milkhouse Creek, interception, rainfall

Introduction

The Dog River Watershed covers approximately 95 square miles (Dog River Clearwater Revival 1998). Milkhouse Creek is a creek located in the Dog River Watershed. It originates in the most northern portion of the watershed, and then proceeds to flow in a southerly direction crossing Old Shell Road, Airport Boulevard, Grelot Road, and Cottage Hill Road before linking with Halls Mill Creek. The water that flows through this creek eventually flows into Dog River and then into Mobile Bay. A tributary of Milkhouse Creek is the focus of this research. It is located just north of Grelot Road and east of the Somerby Retirement Community. This tributary begins near Providence Hospital and flows south for approximately one mile to Grelot Road. The Somerby Retirement Community has set aside a quarter mile section of their land alongside the creek as a green belt/buffer strip for environmental and aesthetic purposes

(SaveMilkhouseCreek.org 2008). The developers, in conjunction with city planners, stipulated that there would be no development in this area (SaveMilkhouseCreek.org 2008).

This tributary, and the green belt, is of great concern to the residents of the adjacent neighborhood and Somerby because Alabama Power Company (APC) has proposed a transmission line to run directly through the green belt and stream area. It will even overtop the creek in places. The power transmission line will consist of towers 100 feet tall, and carry 115,000 volts of power (SaveMilkhouseCreek.org 2008). In order to construct this tower, APC will have to cut a 100-foot wide right-of-way that will run through the middle of the buffer zone. The concerned citizens of Save Milkhouse Creek are in opposition to the proposed site of the transmission line. They believe that it will exacerbate the erosion, runoff of pollutants, and existing flooding hazards of the area.

Deforestation affects the environment in several ways. It can lead to changes in microclimates, soil properties, groundwater properties, and water quality (Lal 1995). It can have an effect on microclimates by leading to an increase in the magnitude and intensity of insolation reaching the forest floor (Lal 1995). This is because as more canopy cover is eliminated, more sunlight can reach the floor. As for soil properties, deforestation allows more rainfall to reach the floor, causing increased runoff and erosion (Lal 1995). Experiments have shown that deforestation can degrade soil structure, decrease infiltration rate and porosity, and increase compaction (Lal 1995).

A 15-foot sewage line right-of-way is already in the area. It has had numerous problems in the past, due to stormwater. Stormwater infiltrating into the pipeline causes the carrying capacity to be exceeded and the manholes to overflow. In 1999, 311,150

gallons of raw sewage spilled into the tributary (ADEM 2005). Another problem the pipeline has is caused by erosion. The running water erodes and undercuts the pipes, causing them to rupture (SaveMilkhouseCreek.org 2008). This leads to raw sewage flowing directly into the tributary. Mobile Area Water and Sewer System is also concerned about the location of the power line; fearing that it would negatively impact their sewage line, causing more problems.

The concerned citizens have proposed an alternative route for the transmission line (SaveMilkhouseCreek.org 2008). Their alternative site will have the transmission line run from the substation behind Providence Hospital to Cody Road and then use the existing right-of-way along Cody Road to connect to Grelot Road and down to the substation located east of the Grelot Road and Leroy Stevens Road intersection.

Through the technique of interception loss, this research seeks to determine the effects the transmission line would have on the Milkhouse Creek tributary area. Interception loss is the portion of incoming rainfall retained by the canopy and evaporated without adding to the moisture of the soil (Swank 1968). An existing 100-foot right-of-way will be used in order to compare measurements and see what affect they have on streams.

Research Question

How much rainfall is lost through interception in a tributary of Milkhouse Creek?

Methods

To test interception loss, I placed rain gauges in two different areas in order to capture rainfall. The gauges are Taylor Model 2710 Glass Rain Gauges with a 5 Inch capacity (Figure 1). They were mounted on planks of wood twenty-one inches long and three inches wide. This was in order to prevent them from being carried away by running water. Twenty rain gauges were constructed in this manner. Ten of them were placed in each area on March 25, 2009. One area in which rain gauges were placed was the old growth forest of the tributary area; the other was in the vicinity of a 100-foot power line right-of-way.



Figure 1: Photo of the type of rain gauge used during the research

The tributary is located north of Grelot Road between Somerby Retirement Community and Lamplighter Woods subdivision. In the tributary area, the gauges were placed along the proposed path of the transmission line. The transmission line site is located at the intersection of Snow Road and Airport Boulevard. Rain gauges were placed randomly in both areas so as to be free from bias. The rain gauges were checked after every rainfall event. They were usually checked the day after, but no more than three days after a rainfall event, so that any evaporation that may occur would not have an effect on the levels of rain captured.

After the raw data was collected, it was entered into Microsoft Excel (Appendix A). From here, I found the median of the data and then separated the data into those measurements that were above the median and those that were below the median. The

total number of measurements above and below the median in each of the areas was then put into a Chi Square Table for a median test. The Chi Square median test was set up with a significance value of .05 and 1 degree of freedom. This resulted in a critical chi square value of 3.84.

In addition to the data collection, a map was produced showing the study areas (Figures 2 and 3). The map was created using ESRI's ArcGIS software. This was done by using City of Mobile data that can be accessed via their website <http://maps.cityofmobileorg/metadata/main.aspx>.

Results

Three rainfall events occurred during the course of this research. The first rainfall event occurred between March 26 and 27, 2009. This was a long, hard storm that produced a large amount of rain. The rain gauges were checked on March 29, 2009. In the tributary site, two of the rain gauges were missing, and a third was uprooted. The other

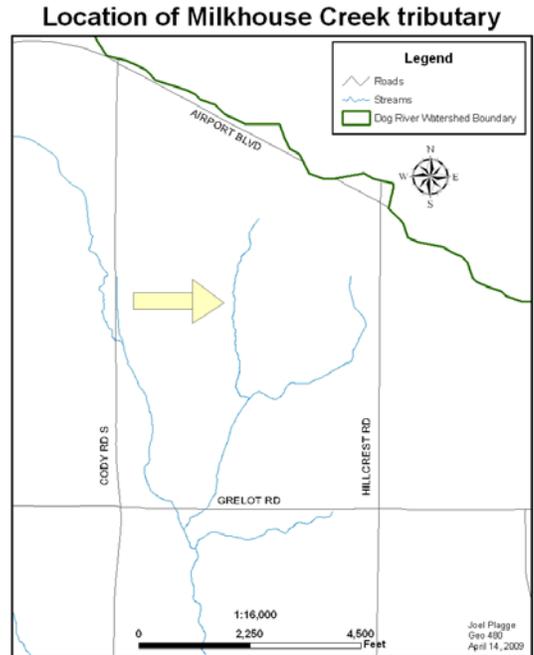


Figure 2.: Map showing the location of the Milkhouse Creek Tributary

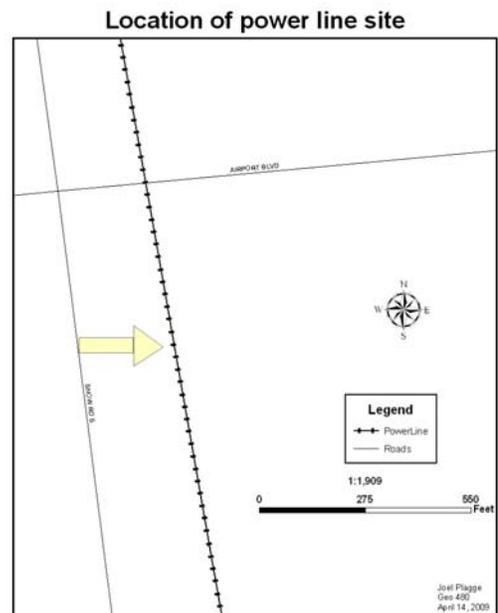


Figure 3: Location of the Transmission Line site

seven were still in place and had captured rainfall. Of the seven still standing, 5 of them had sediment in them. All the gauges in the transmission site were still in place and had captured rainfall. The median rainfall amount for this event was 10.75 centimeters. A Chi Square test could not be performed for this set of data since the gauges were flooded and contained as much as eight centimeters of sediment in them. The second rainfall event occurred on April 2, 2009, this was a shorter duration storm, and rain was captured in all gauges at both sites. The gauges were checked on April 3, 2009. The median for this data was 3.2 centimeters. Several of the gauges in the tributary site were again flooded and contained sediment. A Chi Square test could also not be performed because of this. The third rain event occurred on April 13, 2009. This was the shortest and lightest rain event. The gauges were checked on April 16, 2009. The median for this data was 3.5 centimeters and the Chi Square value was 14.40. This value was above the critical value also, meaning that there was a difference in rain between the two sites. The data was then put into graphical form in Excel (Figures 4, 5, 6).

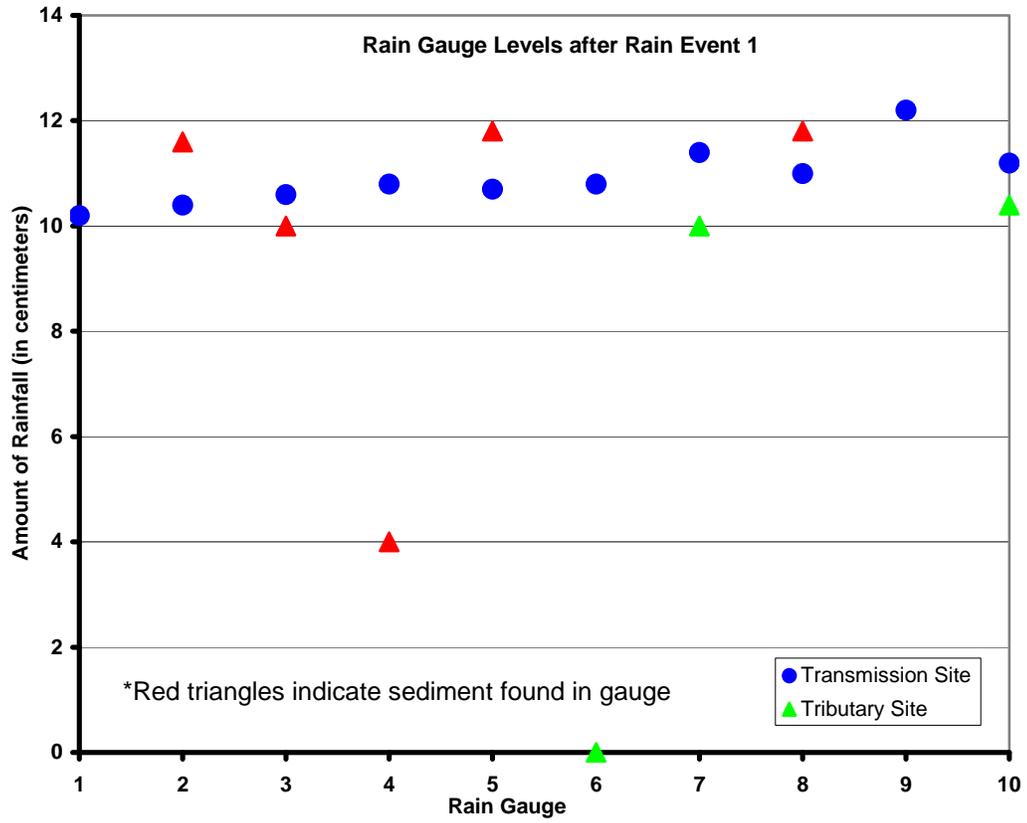


Figure 4: Graph showing levels in rain gauges after rain event 1

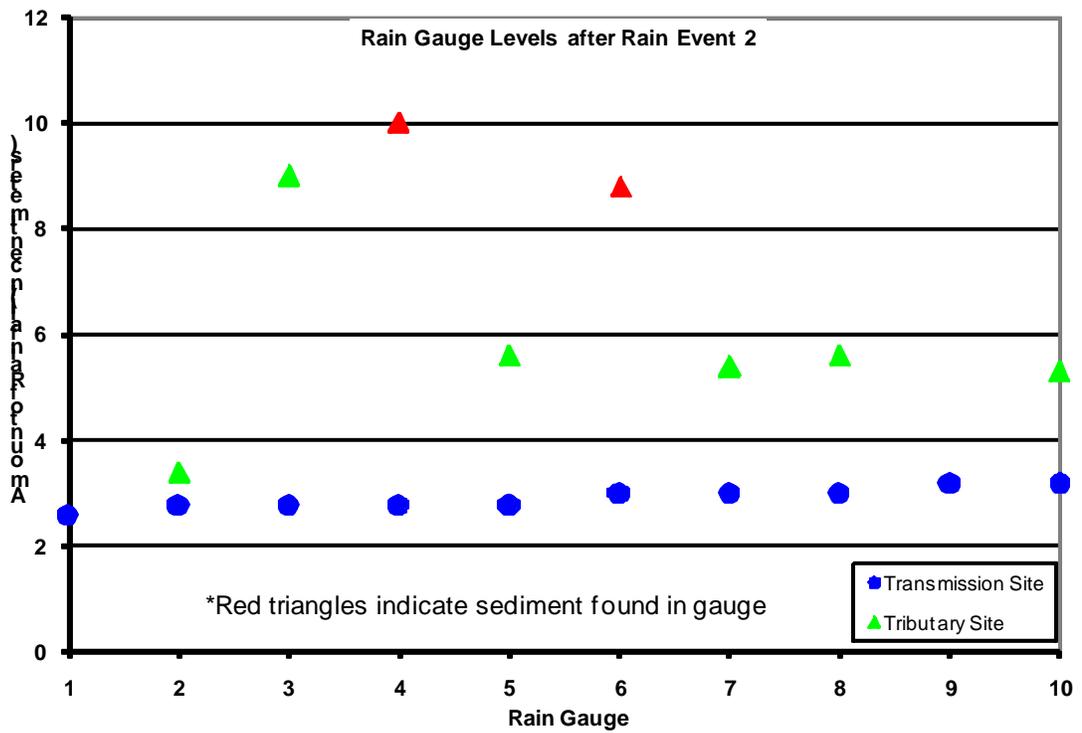


Figure 5: Graph showing levels in rain gauges after rain event 2

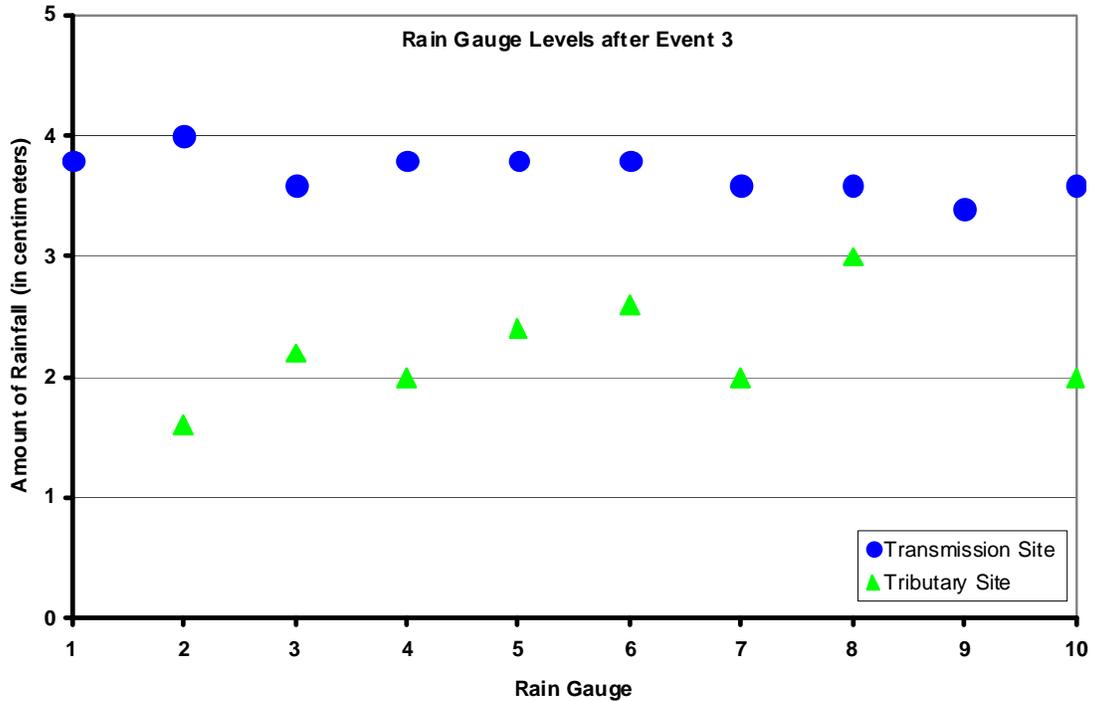


Figure 6: Graph showing levels in rain gauges after rain event 3.

Discussion and Conclusions

The results of this research were not what I expected. The expected outcome was that there would be lower levels observed in the amount of rain that the tributary gauges captured than the transmission gauges did. This was not the instance, rather during two of the rain events; the gauges in the tributary area had equal amounts, or more, rainwater in them than the transmission line gauges. A few problems were encountered throughout the course of this research. These included flooding of the rain gauges in the tributary site, distance between the study areas, and loss of gauges.

Sediment was found in some of the gauges at the tributary site after the first two rain events. The sediment was a problem for two reasons. One was that it showed the gauges were flooded; the other was it gave an inaccurate level of rainwater captured. The first issue that the sediment brings up is that the gauges were flooded. There would have

been no other way to get sand sized particles, or any sized particles, into the gauges unless they had been below the level of running water. The second issue was that the measurements were not of how much rainfall they area received. Since they were flooded, the water in these gauges was what remained in the gauge after the waters returned to normal conditions. Also, the sediment took up space in the gauge, causing the water level to appear higher. The gauge heights ranged between one and two feet above the normal level of the creek. However, in the vicinity of two of the gauges there was what appeared to be a dammed area. A tree had fallen down, and some debris was blocking the channel, cutting off the flow of the water downstream of the area. This could have caused the water to back up enough to have to find another route.

The second problem encountered was the distance between the locations of the study areas. They are approximately six miles apart. This distance difference could be large enough to produce different rainfall amounts in each of the areas. If the project were to be done again, a transmission line right-of-way closer to the tributary site would be chosen.

Even though the gauges were placed at higher points, two of the gauges in the tributary area were lost after the first rainfall event, and one was found uprooted and laying in some debris. This could also skew the data, since there were ten readings per rainfall event in the transmission line area, and only eight, seven for the first event, in the tributary area. If the project were to be done again, mounting the gauges on sturdier pieces of wood would be advisable. Placing them at even higher points in the area, points that would be out of reach of rising, flowing water, would be desirable.

Having only one data set with which to perform the statistical test, a strong conclusion cannot be made. Although that test shows the rainfall amounts were statistically different, a sample of one is not reliable for research purposes. Additional rain events would be needed in order to come to some definitive conclusions.

SaveMilkhouseCreek.org could possibly use this in order to stop the building of the transmission line right-of-way. Although the data is inconclusive, the fact that the area gets enough rain to raise the level of the creek to flood the gauges shows that anything built here would be susceptible to major problems.

References

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Appendix A: Raw Data

Rain Gauge Measurements

Gauge	Transmission Site Event 1	Tributary Site Event 1
1	10.2	No Data
2	10.4	11.6
3	10.6	10
4	10.8	4
5	10.7	11.8
6	10.8	0
7	11.4	10
8	11.0	11.8
9	12.2	No Data
10	11.2	10.4
	Below 4	Below 5
	Above 6	Above 3
	Median	10.75

	Transmission Site Event 2	Tributary Site Event 2
1	2.6	No Data
2	2.8	3.4
3	2.8	9
4	2.8	10
5	2.8	5.6
6	3	8.8
7	3	5.4
8	3	5.6
9	3.2	No Data
10	3.2	5.3
	Below 10	Below 0
	Above 0	Above 8
	Median	3.2

	Transmission Site Event 3	Tributary Site Event 3
1	3.8	No Data
2	4.0	1.6
3	3.6	2.2
4	3.8	2.0
5	3.8	2.4
6	3.8	2.6
7	3.6	2.0
8	3.6	3.0
9	3.4	No Data
10	3.6	2.0
	Below 1	Below 8
	Above 9	Above 0
	Median	3.5